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New potential in direct seeding systems

It's not the 'revolution' that launched the concept, but an 'evolution' into a new era

Few things have made as big an impact on Western Canadian agriculture as direct seeding. From humble beginnings, the concept rumbled like a freight train through the industry, dominating discussion on farm meeting agendas and in coffee shops throughout rural Canada and amassing new devotees and system improvements year after year.

"Direct seeding is a dynamic and ever-changing system and we will continue to see innovations."

It would appear we're not done yet, say researchers with the AgTech Centre in Lethbridge, Alberta who have been at the forefront of developments in the field since the concept was first introduced. While the honeymoon stage is long over as the practice becomes more and more commonplace, the opportunities, with diverse benefits such as fuel efficiency and value-based marketing on the horizon, continue to grow.

"Direct seeding is a dynamic and ever-changing system and we will continue to see innovations," says Rick Atkins, manager of Alberta Agriculture and Rural Development's (ARD) Technology and Innovation Branch, Environmental Stewardship Division. "The ability to adapt to new technologies will be an ongoing driver of opportunity for Western Canadian producers seeking production advantages and looking to get the most value from direct seeding systems."

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Alberta

THE NEXT GENERATION OF DIRECT SEEDING

Trends and new technology

Many believe the biggest impact for direct seeding is yet to come. New systems continue to be developed while existing technologies continue to evolve and thrive. In many ways, the opportunities for producers to save money through direct seeding – not to mention meeting growing consumer demand for sustainable environmental practices – are greater than ever before, says AgTech manager Lawrence Papworth. Here's a snapshot of today's trends and what's in the pipeline for the future.

Seed placement rethought

Driven largely by the system's optimal horsepower requirements, placing seed at the same depth as fertilizer in a double-shoot operation has evolved to become the gold standard in seed placement, says Papworth. Most opener manufacturers have responded by tailoring their openers to this system. For producers still placing their fertilizer two to two-and-a-half times deeper than their seed, Papworth says equal seed and fertilizer depths represent perhaps the greatest opportunity to optimize their direct seeding systems.

Improvements in seed placement accuracy have driven new crop options for producers, says Papworth, particularly for crops like canola that require placement at a shallow point in the seedbed. Floating openers, for example, have made seed placement more accurate and easier for producers to control. "Because there's a setting on each individual shank, producers no longer have to control the depth of 40 to 50 openers with a single setting. As a result, more canola is being planted because seed can be placed at a shallower depth more easily."

Other technologies drawing interest among producers are seed bed levellers and air diffusers. "These have become known for their improved and even seed placement, packing or soil surface levelling," says Papworth.

Low-disturbance Cross Slot openers are also worth keeping an eye on, he says. These single-disc openers place seed and fertilizer in horizontally separated bands or "slots."

"Cross Slot openers replace residue over the slot and trap moisture in the slot. This helps assist germination even in very dry soils," says Papworth. "I have heard great things about the technology and am not sure why it hasn't caught on."

Path of progress. The rise of residue management systems (top), the rethinking of seed placement (middle) and the refinement of disc opener technology (bottom) have all been key developments in the progress of direct seeding systems.

Hoe vs. disc openers

A choice between hoe and disc openers has always been a management system, says Papworth. The advantages of hoe openers come down to their cost efficiency and their ability to penetrate dry soils. Their main disadvantage is their potential for soil disturbance resulting in soil scatter and in-row weed growth.

"One solution to this is to slow down. However, this can lead to reduced field efficiencies. Another is to go to very narrow hoe openers. This is good as far as penetration and soil disturbance is concerned but it goes against the advantages of seed bed utilization."

Disc openers, meanwhile, are associated with accurate seed placement, especially when placing oilseeds at shallow depths, says Papworth. "Discs have the disadvantage of straw pinning into the seed bed. Solutions include disc setups such as coulters that are better at cutting residue and the development of stubble management systems."

Residue managers

The AgTech Centre recently investigated the effectiveness of residue managers and wheels while direct seeding field crops. "We determined that residue managers and wheels are viable options for use with hoe and disc openers but differences in crop emergence and yield occurred infrequently," says Papworth.

"Two systems, the Brummelhuis Seeding System and the Siemens residue wheel worked very well at clearing residue, allowing the seeder to operate without plugging. Unfortunately, these two systems are not commercially available."

All soil types can benefit

Soil type is typically not an insurmountable limiting factor when it comes to the effectiveness of most openers today. "While it's true that some openers do work better in certain types of soil, from what we've seen most openers will work in most soil types provided they are used and set properly," says Papworth.

In some cases, it's a matter of choosing the right equipment, he says. For example, an air seeder is better suited to wet soil areas. Air seeders don't pack soil directly over the seed, but in wet soil, the seed is likely to germinate regardless of whether soil has been packed around it.

The bottom line is that producers shouldn't rule out the switch to direct seeding because of soil type. "Loamy soils

HISTORY WILL DRIVE FUTURE

A look at the evolution of direct seeding systems

Although certain principles of the practice had been around for several decades beforehand, most would agree that the modern era of direct seeding began with the advent of the air seeder in the 1970s. In many ways it was a humble beginning, with the early machines presenting challenges such as inconsistent seed placement, inaccurate metering and distribution, plugged openers and distribution hoses, and significantly rougher fields.

In the process, many producers' first impressions of the practice were mixed at best. "Many test strips were seeded and they usually occurred next to the road so that all the neighbours could see the mistakes," says Rick Atkins, manager of ARD's Technology and Innovation Branch, Environmental Stewardship Division.

At the same time, these challenges became the driver for improved technologies, with each new innovation driving greater producer interest. Seed placement was one of the first challenges around which the industry rallied, culminating eventually in the double-shoot systems for seed and fertilizer used by many producers today. Another important development was the floating hitch and flexible frames to improve seed placement accuracy in a larger range of soil and land conditions.

There were unintended consequences as the evolution wore on, says Atkins. Metering and distribution were quickly exposed as limitations, which in turn led to larger air systems which strained the hydraulic limits of tractors of the day. "The industry responded by equipping air carts with their own engines or installing hydraulic cooling systems. In time the tractor manufacturers responded," he says.

"In the meantime, metering systems improved to the point where they could handle different products and rates of application. Distribution systems, over a long process of trial and error, were refined to the point where they are now comparable to conventional drills."

As these systems improved, producers began to recognize reductions in production costs as a key benefit of direct seeding. Part of these savings included the number of hours they were spending on the tractor. "Many producers quickly discovered that they were putting in 25 to 40 percent fewer hours per year on their primary tractor," says Atkins.

Broad benefits

Another clear benefit has been soil quality. "Direct seeding leaves a greater amount of organic matter in the soil. The result is a reduction in soil strength and typically better soil moisture, structure and nutrient value. Because of this, producers generally do not have to seed as deep, which means they really don't need hoe openers anymore. It also means they can pull larger implements with smaller tractors due to less draft, which again has the potential to increase efficiencies."

The development of direct seeding has also driven secondary industries to support a more effective system, says Atkins. Examples include straw and chaff spreaders, heavy harrows, guidance systems and header stripper harvesting systems.

Perhaps one of the most dramatic effects of direct seeding, says Atkins, is that it has opened up new options for crops that were previously unfeasible in Western Canada under conventional systems. One example on the horizon is Camelina, which can be seeded in the fall and winter directly into snow covered fields.

So what kind of equipment challenges do new developments such as this present? "The reality is that one system does not fit all," says Atkins. "Each farm has its own unique conditions in terms of soils, rotation, climatic conditions, seasonal variations and other factors. It's very much a site-specific management challenge for producers to find the systems that work for them and to maintain the ability to adapt going forward. The drivers will change as time goes on."

are best for direct seeding, while sandy or heavy soils may not be. But, because direct seeding is a cropping system that maintains crop residue and conserves moisture, it's the sandier, heavier soils that can benefit the most."

New nutrient options

As long as producers have wallets with bottoms, chances are there will always be a demand for either less expensive nutrient sources or systems that can stretch the value of existing nutrients. Although most are in their niche stages right now, Papworth says new technologies are in the pipeline that may offer potential for producers to get more bang for their nutrient buck.

Biochar is one such option. This process involves heating straw in an oxygen-free tank until it becomes coal, then applying it to the soil as a supplement once every five years. It then systemically leaches into the soil over time. Another is the new wave of anhydrous ammonia meters, such as Exactrix, whose manufacturers claim can meter product more accurately, saving producers money in the process.

Perhaps the most potentially controversial new system is Bio-Agtive Emissions Technology. The manufacturers claim this system recycles machinery exhaust emissions into soil-injectable plant nutrients. Going by what he has heard from researchers and producers, Papworth says opinion on the system in the research community varies greatly while most farmers experimenting with the system are taking a cautious approach.

Weed control

One of the biggest challenges of direct seeding, particularly for producers putting the practice in place for the first time, is weeds. Not surprisingly, then, weed control continues to be a focal point in direct seeding related research.

In many cases, weed management in direct seeding systems requires being open-minded to new management practices, says Papworth. For example, probably the best way to control dandelions – one of the most common weeds producers experience when direct seeding – is to spray after fall harvest before winter freeze-up. "This method allows you to kill the weeds with the pesticides going into the roots," says Papworth.

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Row spacing remains controversial

The question of whether to use narrow or wide spacing between rows continues to be a source of controversy among researchers. For Papworth, the question comes down to which system allows the best seed bed utilization. "When you use a wide row spacing, seed placement can be compromised and that can mean reduced yields. That's why I generally suggest narrow row spacing to producers."

However, there are cases where wider row spacings are appropriate. "One of the big reasons wider row spacing came about was so seeders could clear crop residue," he says. "If farmers have a seeder on a 12-inch spacing and they're growing a heavy enough crop that they need that 12-inch spacing to clear the residue, then the system's alright. But if the yield isn't high enough, I would suggest going to a more narrow row spacing."

Residue managers have become a key field of research at the AgTech Centre. Pictured is a Terra-Tine row cleaner by Great Plains Manufacturing.

A nine-inch spacing is a good compromise that allows seeders to clear residue without spacing too wide, says Papworth. "You can put a little wider opener on that kind of system and in the process increase your seed bed utilization," he says.

Other ongoing areas of controversy include the debate over in-row versus between row fertilizer placement and the ideal seed to fertilizer placement. Ultimately, these are individual management decisions relating to specific farms and systems, says Papworth. "If it doesn't rain, it doesn't matter which system you use. The cost of energy is another factor – power input requirements might outweigh a potential yield response from optimum seed and fertilizer placement and row spacing."

Row width – be flexible

AgTech research has revealed that, in most cases, increasing row width leads to an increase in yield. Again, seed bed utilization is the key here, says Papworth, as wider rows generally lead to better use of the soil and its nutrients.

At the same time, it's important to be flexible when it comes to row width in order to grow different crops and respond to market conditions. "Some crops, like canola, call for more narrow seed rows. You wouldn't want to use a four-inch row when planting canola because wider rows mean that you have to place the seed deep enough that the soil flows around the opener. That means it's usually too deep for canola, which demands more shallow seed placement."

Crop rotations

Most producers are learning that carefully planned crop rotations go hand-in-hand with direct seeding, says Papworth. Without the option of tillage to manage crop residue, the potential for a crop to contract disease increases dramatically. Producers' key tool for fighting this problem in a no-till, direct seeding system is crop rotations combined with pre-seeding burnoff and, if necessary, in-crop chemical application.

Cereal on cereal rotations are generally not effective in a direct seeding system because disease can carry over from one cereal crop to another, says Papworth. A more suitable crop rotation for direct seeding would be a cereal with an oilseed or a pulse. In that case, volunteers would be easier to handle and disease is less likely to be carried over.

Cheaper direct seeding

The cost of direct seeding systems can be intimidating, especially for producers putting the practice in place for the first time. One budget-friendly option, says Papworth, is the Technotill packer. The Technotill uses a burr located directly behind the opener instead of a separate wheel for packing, making it ideal for seeding into wet soils. But perhaps the most attractive feature, he says, is the bang for your buck.

"It's a lot cheaper way of getting into direct seeding than buying an air drill. You can take an old chisel plough, put a set of Technotill packers on it and you have a tool for direct seeding. It can easily save $30,000 to $40,000 compared to the price of a new air drill." ✦

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